

WHAT IS CLAIMED IS:

1       1. An exhaust gas purifying system comprising:  
2           an oxidation catalyst disposed in an exhaust passage  
3        of an engine;

4           a filter disposed in said exhaust passage at a  
5        position downstream of said oxidation catalyst to collect a  
6        particulate matter contained in exhaust gas;

7           a regeneration start determining means for  
8        determining a regeneration start of said filter;

9           a regenerator means for regenerating said filter;

10          an oxygen mass flow rate detecting means for  
11        detecting or calculating a mass flow rate of oxygen fed to  
12        said filter; and

13          a regeneration end determining means for determining  
14        a regeneration end of said filter in accordance with  
15        information provided from said oxygen mass flow rate  
16        detecting means and upon arrival of an integrated value of  
17        said oxygen mass flow rate at a predetermined value during  
18        regeneration of said filter by said regenerator means.

1       2. An exhaust gas purifying system according to  
2        claim 1, further comprising a temperature detecting means  
3        for detecting the temperature of said filter, and

4           wherein said regeneration end determining means  
5        determines a regeneration end of said filter in accordance  
6        with information provided from said temperature detecting

7 means and said oxygen mass flow rate detecting means and  
8 upon arrival at a predetermined value of an integrated  
9 value of said oxygen mass flow rate from the time when the  
10 temperature of said filter has reached a predetermined  
11 temperature.

1           3. An exhaust gas purifying system according to  
2 claim 1,

3           wherein said regeneration end determining means  
4 determines a regeneration end of said filter upon  
5 establishment of the following equation:

6            $\Sigma \Delta PM = C \cdot \Sigma$  (oxygen mass flow rate)

7           where,  $C = A \cdot PM \cdot e^{(-E/RT)}$

8            $\Sigma \Delta PM$ : target combustion quantity of particulate  
9 matter

10            $\Sigma$  (oxygen mass flow rate): integrated value of  
11 a mass flow rate of oxygen fed to the filter

12           A: constant obtained by experiment (frequency  
13 factor)

14           PM: amount of particulate matter deposited on  
15 the filter at the beginning of regeneration

16           E: activation energy constant

17           R: gas constant

18           T: filter temperature

1           4. An exhaust gas purifying system according to  
2 claim 1, further comprising an air flow sensor for

3 detecting a flow rate of intake air, and  
4 wherein said oxygen mass flow rate detecting means  
5 calculates the oxygen mass flow rate  $O_{2w}$  in accordance with  
6 the following equation including the mass flow rate of  
7 intake air  $Q_{aw}$  obtained from said air flow sensor:

8 
$$O_{2w} = (Q_{aw} - q \cdot a) \cdot b$$

9 where, q: fuel injection quantity

10 a: equivalence ratio

11 b: oxygen mass ratio

1 5. An exhaust gas purifying system according to  
2 claim 1, further comprising:

3 an  $O_2$  sensor disposed between said oxidation catalyst  
4 and said filter to detect an oxygen concentration; and  
5 a sensor for detecting the flow rate of fluid  
6 entering said filter, and

7 wherein the oxygen mass flow rate detecting means  
8 calculates the oxygen mass flow rate  $O_{2w}$  on the basis of  
9 detection results provided from said two sensors.

1 6. An exhaust gas purifying system according to  
2 claim 1,

3 wherein said regeneration end determining means has a  
4 combustion quantity estimating means for calculating or  
5 estimating a combustion quantity of the particulate matter  
6 collected by said filter,

7 wherein said combustion quantity estimating means

8 calculating or estimating a combustion quantity of the  
9 particulate matter by multiplying the integrated value of  
10 the oxygen mass flow rate obtained from said oxygen mass  
11 flow rate detecting means by a predetermined coefficient,  
12 and

13 wherein the end of regeneration of said filter is  
14 determined upon arrival at a predetermined target value of  
15 the combustion quantity of the particulate matter  
16 calculated or estimated by said combustion quantity  
17 estimating means.

1 7. An exhaust gas purifying system according to  
2 claim 6,

3 wherein said regeneration start determining means has  
4 a deposition quantity estimating means for calculating or  
5 estimating a deposition quantity of the particulate matter  
6 deposited on said filter, and

7 wherein said predetermined target value is a  
8 deposition quantity of the particulate matter at the  
9 beginning of the regeneration which is estimated by said  
10 deposition quantity estimating means.

1 8. An exhaust gas purifying system according to  
2 claim 2,

3 wherein said temperature detecting means is a  
4 temperature sensor disposed downstream of said catalyst,  
5 and an outlet temperature of said catalyst is used as the

6 temperature of said filter.

1 9. An exhaust gas purifying system according to  
2 claim 2,

3 wherein said temperature detecting means comprises  
4 temperature sensors disposed upstream and downstream  
5 respectively of said filter to detect an inlet temperature  
6  $T_f$  and an outlet temperature  $T_r$  of the filter, and

7 wherein said temperature detecting means calculates a  
8 filter temperature on the basis of the inlet temperature  $T_f$   
9 and the outlet temperature  $T_r$  detected by said temperature  
10 sensors and in accordance with the following equation:

11 Filter temperature  $T_{fil} = T_f \cdot a + T_r (1 - a)$

12 where,  $a$ : a value for weighting the inlet  
13 temperature  $T_f$  and the outlet temperature  $T_r$ , satisfying  
14 the relation of  $0 \leq a \leq 1$ .

1 10. An exhaust gas purifying system according to  
2 claim 1,

3 wherein said regeneration end determining means  
4 determines the end of regeneration only during forced  
5 regeneration of said filter.

1 11. An exhaust gas purifying system according to  
2 claim 1,

3 wherein said engine is a diesel engine.

1           12. A regeneration end determining method for an  
2 exhaust gas purifying system comprising an oxidation  
3 catalyst disposed in an exhaust passage of an engine and a  
4 filter disposed in the exhaust passage at a position  
5 downstream of said oxidation catalyst to collect a  
6 particulate matter contained in exhaust gas, said method  
7 comprising the steps of:

8           starting a forced regeneration of said filter;  
9           determining whether the temperature of said filter  
10 has reached a predetermined temperature or not during  
11 execution of said forced regeneration;

12           determining whether an integrated value of an oxygen  
13 mass flow rate from the time-point of arrival of the filter  
14 temperature at the predetermined temperature during  
15 execution of said forced regeneration has reached a  
16 predetermined value or not; and

17           terminating said forced regeneration upon arrival of  
18 the integrated value of said oxygen mass flow rate at the  
19 predetermined value.

1           13. A regeneration end determining method for an  
2 exhaust gas purifying system comprising an oxidation  
3 catalyst disposed in an exhaust passage of an engine and a  
4 filter disposed in the exhaust passage at a position  
5 downstream of said oxidation catalyst to collect a  
6 particulate matter contained in exhaust gas, said method  
7 comprising the steps of:

8           determining whether a forced regeneration of said  
9 filter is being executed or not;

10          determining whether the temperature of said filter  
11 has reached a predetermined temperature or not during  
12 execution of said forced regeneration;

13          determining whether an integrated value of an oxygen  
14 mass flow rate from the time-point of arrival of the filter  
15 temperature at the predetermined temperature during  
16 execution of said forced regeneration has reached a  
17 predetermined value or not; and

18          terminating said forced regeneration upon arrival of  
19 the integrated value of said oxygen mass flow rate at the  
20 predetermined value.